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PlasmidFactory: Pioneering Minicircle DNA for Safer and More Efficient Gene Therapies

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PlasmidFactory, a leading German biotechnology company, is setting new standards in gene therapy and synthetic biology with its advanced production of high-purity plasmid and minicircle DNA.



As the field shifts toward safer and more efficient gene delivery methods, PlasmidFactory's proprietary technology for producing non-synthetic minicircle DNA is gaining rapid attention across academia and industry.

Minicircle DNA has emerged as a next-generation gene vector with clear advantages over conventional plasmids. Lacking bacterial backbone sequences such as antibiotic resistance genes, minicircles are smaller, show reduced immunogenicity, and exhibit significantly enhanced gene expression. Their compact size allows greater cargo capacity and makes them ideal for sensitive applications in gene therapy, vaccine development, and cellular therapies like CAR-T.

Unlike traditional plasmids, minicircles consist primarily of the gene of interest (GOI) and regulatory elements, minimizing unwanted sequence motifs. PlasmidFactory produces these vectors through a patented intramolecular recombination process that removes bacterial backbone DNA, leaving behind only a short residual sequence ("SCAR") under 150 base pairs. The result is a covalently closed circular (ccc) DNA molecule with excellent stability and transfection efficiency.

Studies consistently show that minicircles outperform plasmids in gene transfer. For example, transfection experiments with GFP reporter genes demonstrated increased gene expression, higher transfection efficiency, and improved mRNA transcription levels in various mammalian cell lines.

PlasmidFactory's minicircles are already widely used for:

- **Gene therapy and gene editing:** With support for large cargo sizes (over 22 kbp), minicircles facilitate delivery of multi-component systems such as CRISPR-Cas9.
- **RNA interference (RNAi):** Minicircle vectors expressing shRNAs offer long-lasting gene silencing without triggering strong immune responses—critical for diseases like Parkinson's.
- **Vaccine development:** Custom-designed minicircles containing immunomodulatory elements have shown strong potential in vaccine platforms against cancer and infectious diseases.

- **AAV vector production:** Collaborative efforts with academic partners have led to cleaner AAV manufacturing workflows using minicircle DNA, eliminating the risk of retro-packaging bacterial sequences.
- **CAR-T cell therapies:** Minicircles enable non-viral, low-toxicity transfection of T-cells with higher safety and efficiency, particularly when paired with transposon systems such as Sleeping Beauty or PiggyBac.

In addition to these innovations, **PlasmidFactory now offers plasmid linearization**, an essential service for applications like mRNA synthesis. By ensuring precise and clean linearization, the company helps clients achieve consistent downstream results.

Further solidifying its leadership, PlasmidFactory recently established the world's first GMP facility tailored specifically for minicircle production. Using single-use bioreactors and equipment, the facility is designed to produce DNA for n application, addressing increasing regulatory demands in clinical and commercial settings. The first GMP production runs are expected to be completed by the end of the year.

With its innovative technologies, quality-driven production, and expanding portfolio, PlasmidFactory is at the forefront of delivering next-generation genetic tools for safe and effective therapies.

For more information, visit www.plasmidfactory.com